

# BRANCH FILE COPY SERVICE TRAINING COURSE

(APPRENTICE)

**BOOK NUMBER 1**



Introduction To Our Company  
And  
Function-Adjustment  
**LN** model **CALCULATOR**

GENERAL SERVICE DEPARTMENT  
MONROE CALCULATING MACHINE CO., INC.



# **SERVICE TRAINING COURSE**

## **Book No. 1 For Apprentices**

### **FIFTEEN SECTIONS**

- OUR BEGINNING
- WHAT SORT OF COMPANY HAVE I JOINED?
- YOUR ROLE IN THE COMPANY
- ORGANIZATION
- THE OPERATION
- THREE PLANS OF SERVICE
- SERVICE FORMS
- OUR PLANTS
- AN INTRIGUING PRODUCT
- CODING
- THE PRODUCT
- WHAT'S IN A NAME?
- SEQUENCE OF MOVEMENTS
- TOOLS OF THE TRADE
- ADVANCING

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## FOREWORD

It is the responsibility of every man to improve his skill and thereby raise the value of his labor.

It is our aim to encourage and speed the acquisition of skills by supplying incentives and aids for self-training, and to supplement the self-training, thereby aiding individual apprentices in raising the value of their labor.

Training that speeds the acquisition of skill benefits both the apprentice and the company, and presumably the mutual gain should prompt both to utilize all training opportunities.

Your supervisor will do everything possible to furnish you with an instructor, literature and tools, however it is expected that you will earnestly strive to train yourself and acquire the skill of properly using our tools.

In the preparation of this book, the company has provided the means for you to acquire a thorough understanding of our organization. You, as a beginner, should be interested in the facts contained herein outlining the beginning of the Monroe Company and its growth to leadership in the industry. We pride ourselves on this growth of the company and also the progress of many of our personnel who like yourself began as apprentices.

The mechanical content of this book will not only enable you to understand the workings of the Monroe LN Calculator, but will also serve as a foundation for servicing other models. We trust that you will utilize it to full advantage.



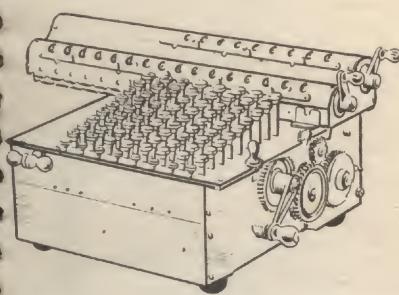
## OUR BEGINNING

FIGURING SERVICE AND EDUCATION ARE SIGNIFICANT FACTORS IN THE  
NOTABLE GROWTH OF MONROE, THE PIONEER CALCULATING MACHINE  
MANUFACTURER



Within the archives of the history of American Technical Progress lies something more than a mere record of the development of the marvelous mechanical and electronic devices which today, many years later, continue to keep the wheels of industry and business turning smoothly. This chapter from 1911 to date includes the story of the Monroe Calculating Machine and its valuable contribution to the advance of civilization through practical education, a broadening of opportunities and a widening of horizons. A prominent part in this modern industrial march has been taken by the Monroe Calculating Machine Company, which in 1957 celebrates its forty-fifth anniversary.

It was in 1911 that Jay. R. Monroe, President and Founder of the Monroe Company, first saw the Baldwin Calculator the invention of Frank Stephen Baldwin. This machine was the first reversible, crank type calculating machine. Although Mr. Baldwin's machine had been patented in 1874 and had been judged by the Franklin Institute as the most noteworthy invention of that year, it had not been developed for commercial use.



Mr. Monroe recognized the merits of the Baldwin Calculator, and saw in this machine, which others had said was "ahead of its time," possibilities for the development of a figuring device which would be invaluable in the business world. He joined forces with Mr. Baldwin and, adopting the basic principles of the Baldwin machine, built a calculator which met Mr. Monroe's requirements. It was simple to operate, performing direct subtraction and division as easily as addition and multiplication, a device which could immediately handle all the figure work of any office without the services of a highly trained operator.

Mr. Monroe was at that time still in his twenties. During his brief business experience, however, he had taken advantage of the opportunity to study at first hand the figuring needs of the business office. After being graduated from a mid-western university, he associated with the Western

Electric Company in Chicago, where his work necessitated a study of accounting methods. Later he moved to the Pittsburgh offices of that company. In 1910 he transferred to their New York offices and was still located there when he met Mr. Baldwin the following year.

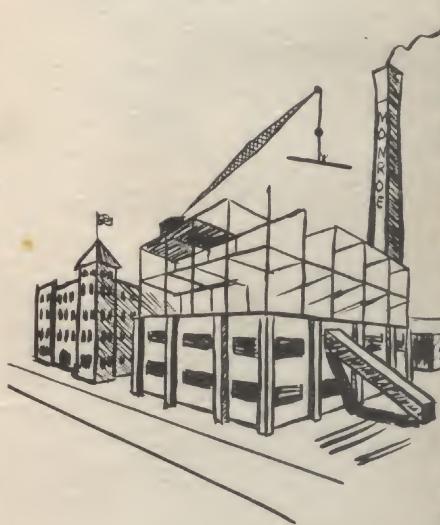
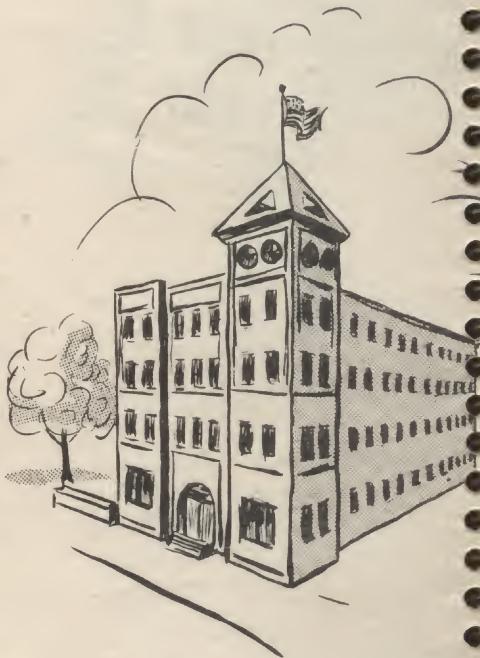
In April 1912 he organized the Monroe Calculating Machine Company, and in a small rented room near Newark, New Jersey, the manufacture of the first Monroe Adding-Calculator was begun. When the new machine was exhibited for the first time at the National Business Show in New York that fall, it was viewed by business executives from all parts of the country and was described as one of the mechanical marvels of the day.

The following year the firm moved to Orange, New Jersey, and occupied part of the first and second floors of the building which now houses the Company executive offices. The factory personnel consisted of only nine men\* and the entire heavy factory equipment was a lathe and two small presses. Even with these meager tools, tolerances were maintained to within thousandths of an inch to insure the accurate performance of the finished machine. This was a noteworthy accomplishment at that time.

When the first Monroe was offered to the business world in 1914, it was immediately recognized by many progressive executives as a valuable instrument of economy. Yet it required ability, energy, and a firm belief in the machine to overcome the prejudices of many who were reluctant to change their time-honored methods of performing computations. However, by perseverance, sales were made and a market was developed.

The demand for the machine increased rapidly and expansion in manufacturing facilities became necessary. The original factory building was soon outgrown and the plant was enlarged to twice its capacity. Two years later, a modern, four-story concrete building fully equipped with up-to-date machinery again doubled the Company's manufacturing facilities. In the next few years purchases were made of additional properties until now the Company's plants occupy large areas in Orange and Morris Plains, New Jersey; Bristol, Virginia; and Amsterdam, Holland.

Early in the Company's history, sales representatives were carrying the story of Monroe figuring economies



\*Mr. Monroe's first two assistants are still alive. One, Mr. Sidney Smith recently retired, the other, Mr. John Bergman, is an active Orange Supervisor.



throughout the United States, and shortly to Europe, Latin America, and the Far East, so that today, in addition to the three hundred and fifty company-owned branches in the United States, Monroe distributors are located in all principal cities throughout the free world.

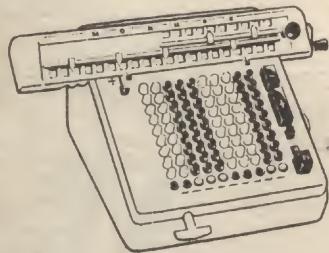
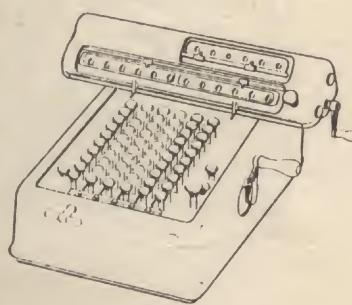
The extraordinary growth of the Company has been possible because the calculator filled a real need, and the Monroe Organization, besides introducing basic principles which are distinctive improvements in calculating machine equipment, adopted a program of education and service which continues to be successful to this day. From the time Mr. Monroe first conceived the idea of developing a machine to lighten the burden of office routine, figuring needs have been kept foremost in mind. Monroe research engineers have left nothing undone to produce instruments that fill computing requirements mechanically, electro-mechanically, or electronically.

From the very beginning, improvements in design have been adopted as fast as they were proved practical. It was not until the introduction of the K series in 1921, however, that any radical change was made in the appearance of the machine. This model, with its rounded corners and graceful lines, embodies still further mechanical improvements, yet retained the basic principles of the original Monroe. Under capable and determined supervision, the Monroe machine has been developed from the single model of 1917, cumbersome and clumsy in appearance, to the attractive, compact calculators of today, made in varied sizes and models.

Following the introduction of the hand-operated K machine came the electrically operated KA series. Various special machines were also introduced to handle special types of work, such as interest, fractions, British currency, etc.

Foreseeing the demand for a small, portable adding-calculator, the Company brought out its "L" series machines. The first one of this series which appeared in 1929 was the 7-1/2 pound Executive Monroe, the smallest calculating machine having a standard keyboard. This was later followed by the small electric LA-5 Monroe, which has the same size keyboard and is electrically operated. The most recent development in the L series is the new color coded LA-7 with automatic division.

In the MA series Monroe which followed, there was developed a quiet adding-calculator which combined with the



features of other Monroe models, such additional advantages as the accumulating dials, split lower dials, and the half-cent dial. These permitted still further shortcircuiting of business problems and made possible the handling of large volumes of figure work even more quickly and economically.

Both the LA-5 and the MA machines were equipped with the "Spot-Proof" keyboard, which is claimed to be the greatest improvement made in keyboard design since the development of the first key set-up calculating machines.

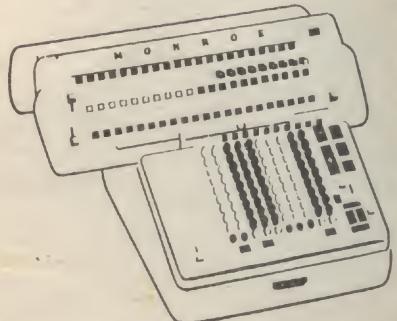
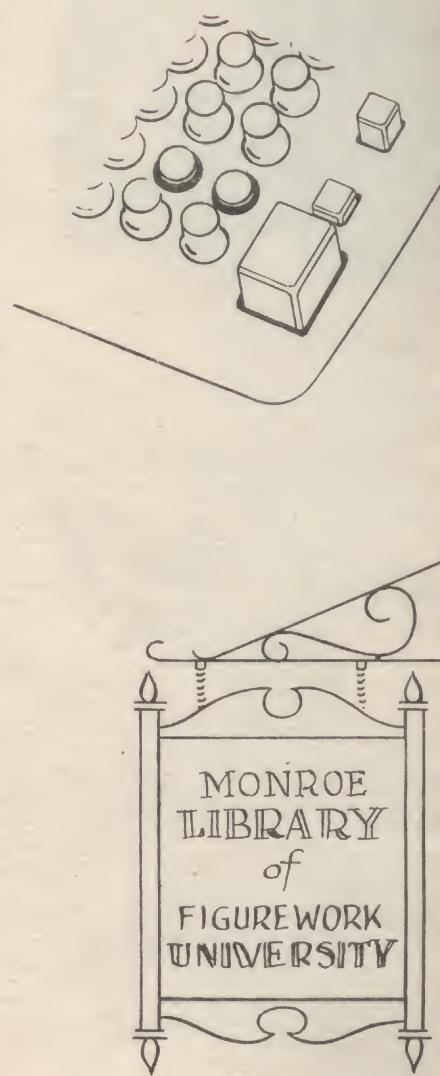
The valuable educational work which has been undertaken by the Monroe Company has kept pace with the development of the Monroe machine. This educational program, which has been part of the policy of the Company since its inception, has been carried on and expanded under the direction of competent specialists.

The Company's educational department cooperates with its sales organization to aid business houses in the application of the Monroe machines to their particular figuring needs.

The Monroe Company's sales representatives, with their highly specialized training, may be considered figure experts, qualified to analyze the customer's figuring requirements and to recommend the best method of handling them. The accounting service departments at the Company's Orange offices is constantly at work on the figuring problems of every line of business. Most of its findings have been published in booklet form so that it is possible to obtain a course of instruction on the figure work of every major line of business.

In 1932, which marked the twentieth anniversary of the Monroe Company, its product was honored for the second time by the Franklin Institute. In the award of the John Price Wetherill Medal for improvements in design and construction which have been made on the Baldwin Calculator and incorporated in the Monroe Adding-Calculator, the institute has recognized a significant contribution to the progress of science in the perfection of a device which has already proved itself invaluable as an instrument of economy in the practical conduct of modern business.

More than 100 different styles of Monroe calculators have been manufactured to date. In 1929 the Monroe Company entered the Adding Machine Business and has since produced many varied models of Adding-Listing and Accounting machines.



Thus the Monroe Calculating Machine Company has accomplished much in the forty-five short years of its existence. The Company has had a definite influence on the conduct of modern business by removing the drudgery of office routine and eliminating the wastefulness and uncertainty of pad-and-pencil figuring methods. It is making a worthwhile contribution to business and industry through its simplification of figure work.

The Monroe Company continues to grow at an unprecedented rate which accordingly affords unusual opportunities to capable persons who desire to grow with it and fill worthwhile places in its ranks.

Inasmuch as all mechanical devices require normal care, it naturally follows that a large, competent and efficient field maintenance organization is required to service the great number of machines sold by the Monroe sales organization. More than 1,100 men comprise the Monroe Field Service Organization within the United States. Each of the Company owned and operated branches has a service department to handle customer requirements within each branch territory.

The schooling of servicemen is arranged systematically so that absorption of mechanical instruction is gradual and thorough.



SERVICE SCHOOL



## WHAT SORT OF COMPANY HAVE I JOINED?

"ONE OF THE BEST BY EVERY YARDSTICK" SAY YOUR CO-WORKERS

This question runs through the minds of most new employees as they begin their apprenticeship. There isn't a better time to talk over this question than now when a man is about to start his Monroe career.

Undoubtedly, you prefer to get the answer from the fellow who has worked at, and lived through, the various jobs faced by the new beginner. We will go along with your reasoning in choosing a plain "John Doe" to serve as the fellow to interview on "What sort of a Company have you joined?"

We put the question to quite a few chaps who have worked for Monroe for periods ranging from three months to forty years, and their comments sum up as follows: "The Monroe Company is a good place in which to work because of the nice folks who comprise its personnel. These folks have a way of working for a living that brings into it more spirit of friendship, help, and fair play than is usually associated with the daily task of conducting an everyday business. The Company is a stable one of sound background and well established in its field. It has many years of valuable experience behind it -- yet is young. It is well established in character, know-how, and integrity -- yet it is still growing, flexible, and accepting new industrial challenges. The Company is exceedingly fortunate in having as its pillars select groups of experienced specialists who are pioneers in the development and growth of the office machine industry and the Monroe Company of today. Our Company is one that makes it possible for men to rise through the ranks to the top executive positions of the firm!"



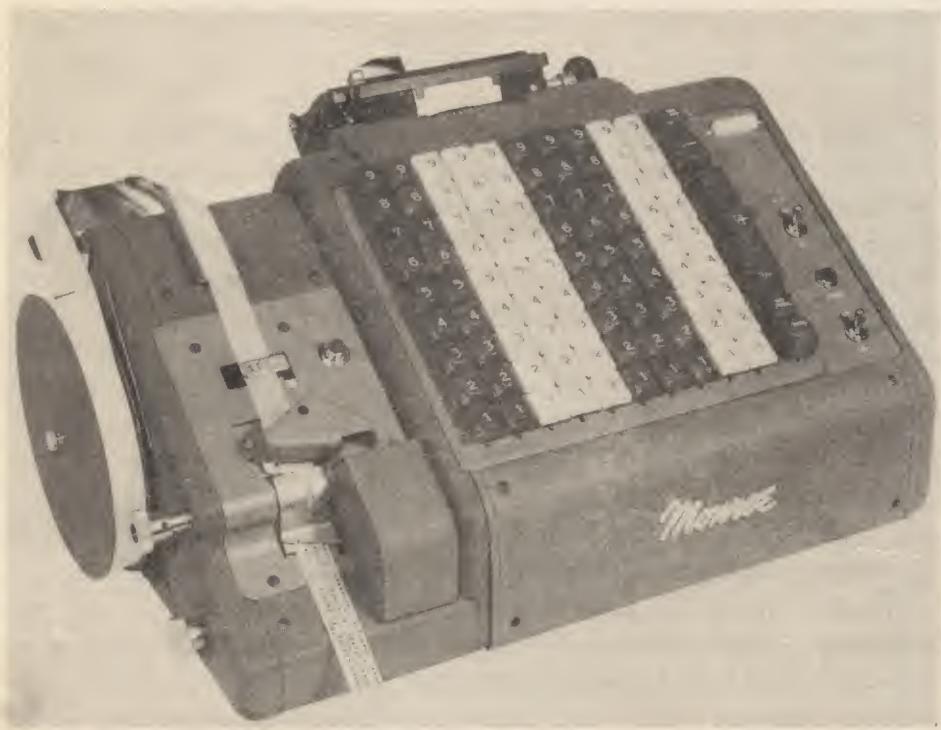
"Of course, everyone cannot be a chief, but the opportunity is there. We know of no other company that has more to offer."

In your role as serviceman, you will come in contact with many of our older models just as a new car sales agency service department is required to service the many previous car models. We spur the sale of our new models, to be sure, but as a service organization we invite revenue from the servicing of Monroe machines of earlier release. It is this income that pays your "SERVICE" salary and mine.

In addition to the machines you will service as an apprentice, the Monroe Company also produces electro-mechanical models that employ auto-punch hook-ups (perforated tapes) for Teletype and Western Union transmission of computations. We also manufacture fully electronic computers (known to the public as an "Electronic Brain") identified as "The Monrobot".

From all indications, the Monroe Company faces a future of progress and growth and we would like to share it with you.

This, in brief, is the sort of Company you have joined.



SYNCHRO-MONROE  
(ELECTRO-MECHANICAL)

## YOUR ROLE IN THE COMPANY

MANUFACTURING, SALES AND SERVICE -- THE BIG THREE IN THE MONROE PICTURE. INTER-DEPENDENT, ONE COULD NOT ENDURE WITHOUT THE OTHER. YOU, AS A SERVICEMAN, WILL PLAY A VITAL ROLE IN OUR PROGRESS

The serviceman's essential mission is to create the life blood of companies like ours; i.e., Customer satisfaction. The serviceman is the final insurer of the designers dreams, the guarantor of the salesman's pledge. Among the men who do the installing, the instructing, the inspecting and the repairing -- The Monroe serviceman holds a special place -- for, in addition to skill of hand and tool, he serves as counselor in mechanical matters and as ambassador of the Company and its figuring service. To thousands of customers, the serviceman is "MONROE".

The Field Service Organization of more than 1,100 men comprises one of the largest departments of the Company. Located in over 350 service points in the United States, this Field Force constitutes a front line public relations force of tremendous value to our Company. Other servicemen perform their duties in Dealer Agencies throughout the free world.



To be a successful serviceman, there are several outstanding personal requisites which he must possess or acquire. These qualities that we look for are not unusual or unreasonable, inasmuch as they are the same good points that you, yourself, look for and like to see in other persons with whom you come in contact. As an example, you look for and appreciate clean and proper personal habits as well as neat appearance of hair and clothing on other men. They, in turn, expect it of you and others.

Business attire differs from sport or social dress, and each has a definite time and place for usage. Loud clothing or extreme cut suits may reflect the wearer's temperament or distaste for convention, but it does not reflect the Company or its products. Ours is a conservative approach that does not employ extremes and, because of this, our products and Company representatives should blend into a pattern of neatness and public acceptability.

Pride in one's personal appearance oftentimes is reflected in an individual's work. A well groomed man (clean shaven with neatly combed hair, shoes shined, and clothing orderly) invariably works in an orderly fashion. Everyone looks for these qualities in a Monroe Service-man. Also, the value of proper self-expression is priceless to servicemen as well as salesmen. A good command of the English language can be gained through study, if not originally possessed. It can unlock many doors of opportunity for you. Of prime and equal importance, however, is learning when to speak in a customer's office and when not to speak. Do not attract unnecessary attention, but when spoken to, speak clearly, fluently and briefly.



## ORGANIZATION

### WONDERING WHAT YOUR TIE-IN IS WITH THE COMPANY?

As a serviceman, you report to the Branch Service Manager who is responsible for all service operations within the territorial confines of the Branch in which you are located.

The Service Manager reports to the Branch Manager who is directly in charge of all operations of the branch. The Branch Manager reports to a Division Manager, who, in turn, reports to the General Sales Manager at Orange. There are seven (7) Sales Divisions in the United States, identified as Metropolitan, Northeastern, Central, Southern, Southwestern, Eastern, and Pacific.





## THE OPERATION

### What does the boss expect of you during working hours?

Nothing unreasonable to be sure. All you are expected to deliver is a good day's work -- done quietly, efficiently and tactfully. You must acquire a thorough knowledge of the mechanisms of our products and understand the purpose and movements of their many parts. A good serviceman is measured, not by the use of his instruments and tools alone -- his ability to diagnose a situation correctly is equally important. A good serviceman has a good analytical mind which enables him to "size up" a situation quickly and accurate and put his finger upon the source of the trouble. If your car is not functioning as it should and you take it to a repair garage, what would and wouldn't you expect the repairman to do? Surely, you would not want him to pull apart the entire car or its motor in search of your trouble! That would be time-consuming, costly and wasteful. Instead, you would tell him what occurs and his trained mind and hands would pin-point the troublesome spot, thereby permitting you to have your car back in good condition quickly and serviced at a reasonable cost. The Monroe customer has a right to expect the same.



There is an old saying that goes something like this: "It's the little things that count". In other words, as one fellow said, "It's not the elephants that bother the people; it's the flies."

Customers are just like you and me -- impatient for action and expecting perfect service. Every man who deals with customers has to adjust himself to this state of mind and be ready to deal with it. If he doesn't adjust himself to it, he's going to lose the good will of customers that could easily have been kept. Yes, customers are unreasonable at times! But their very unreasonableness gives you a wonderful opportunity to show what superior service you can render. If they weren't unreasonable at times, anybody could satisfy them.

Rendering fast, reliable service is your job, and it is an important and interesting one.



SECTION (E) QUESTIONNAIRE

STUDENT \_\_\_\_\_ BRANCH \_\_\_\_\_ DATE \_\_\_\_\_

ORANGE EXAMINER \_\_\_\_\_ RIGHT \_\_\_\_\_ WRONG \_\_\_\_\_

1 Q. What prime abilities do you expect of any serviceman to whom you entrust your car, television set, radio, wrist watch, etc.?

List these requisites in order of importance.

A. 1 *honesty*

2

3

4

5

2 Q. How is a good serviceman measured?

A. *1-E*



## THREE PLANS OF SERVICE

ALL ARE EQUALLY IMPORTANT



1. The Monroe Company guarantees each of its new machines for a period of one year from date of purchase. During that time, if service is required, we provide labor and parts at no charge to the customer. See attached sample Guaranty.
2. Our company offers the users of Monroe machines a means of ensuring uninterrupted figure work through the protection of M.G. contracts. For a nominal fee the customer can buy a contract for a full year of protection. During the year the contract is in force, Monroe servicemen make a specified number of calls to the customer's shop or office. Each visit results in the serviceman Cleaning, Oiling and Inspecting the machine. If, during the year, the machine requires other service, we provide labor and material without charge. See attached M. G. Contract.
3. When machines become older than one year and the customer does not avail himself of the benefits of an M. G. Contract, any service required is furnished on a "Time and Material" basis. This means that the customer is billed for the parts used and the serviceman's time and travel required to do the job.

It is advantageous to both the customer and the Company to promote the use of M.G. contracts and because of this, emphasis is placed on such sales. Contests are conducted to promote M.G. contract sales and servicemen may win prize money, merchandise, and share in bonus awards also.

YES! I WILL PUT ALL MY  
MONROES UNDER M. G.  
IT IS A GOOD INVESTMENT.



**GUARANTY:** New Machine Guaranty, Form 746-S, (below) provides free maintenance to the original purchaser for a period of one year.

Maintenance Guaranty Contract, Form 862-S, (right) is sold to users of Monroe machines at an annual fee.

↗

# Guaranty

*to original purchaser*

On \_\_\_\_\_ you purchased the following Monroe Machine  
MODEL \_\_\_\_\_ NO. \_\_\_\_\_

Under the terms of this purchase we guarantee the maintenance of this machine for the period of one year.

This guaranty includes \_\_\_\_\_ regular inspections of the machine at which times it will be cleaned, oiled, and adjusted without charge.

This guaranty, however, does not include burned-out motors, damages caused by fire, accident, neglect, or abuse, or other causes beyond our control.

At the expiration date of this one year guaranty, annual service may be continued at a nominal cost which provides the same regular inspections as well as any emergency repairs that may be necessary during such yearly periods.

MONROE CALCULATING MACHINE COMPANY, INC.

Date \_\_\_\_\_

Approved: \_\_\_\_\_ by \_\_\_\_\_

Branch Manager \_\_\_\_\_

Branch Office \_\_\_\_\_

*Neal Sullivan* President  
General Offices - ORANGE, NEW JERSEY

FORM 746-S 6-56      ORIGINAL      LITHOIN U.S.A.

# MAINTENANCE GUARANTY

This contract protects the owner of the Monroe machine (s) identified below against further expense for service or parts required for satisfactory machine operation. \* For an annual fee, payable in advance, the Monroe Company guarantees to provide the following items for the satisfactory operation of your Monroe equipment for a period of one year.

- Periodic cleaning
- Periodic lubrication
- Periodic inspections
- Replacement of worn out or defective machine parts
- Replacement of defective or burned out motors
- Replacement of worn out or defective motor cards
- Replacement of worn out rubber plates



- Replacement of worn out rubber feed rolls
- Complete shop overhauls
- Emergency service calls during normal business hours (including labor, travel & parts)
- Use of genuine Monroe parts only
- Contract good anywhere in the United States
- Free packing service for machine shipment
- No age limit

This contract will renew itself automatically each year at the rates in effect at the time of renewal and will continue unless cancelled by either party.

MODEL	MACHINE NUMBER	RATE PER YEAR	MODEL	MACHINE NUMBER	RATE PER YEAR

\*This contract is not transferable and does not cover damage by accident, abuse or arising from acts of third persons or from any force of nature.

SIGNED Monroe Calculating Machine Company, Inc.

SIGNED \_\_\_\_\_  
BY \_\_\_\_\_

BRANCH MANAGER

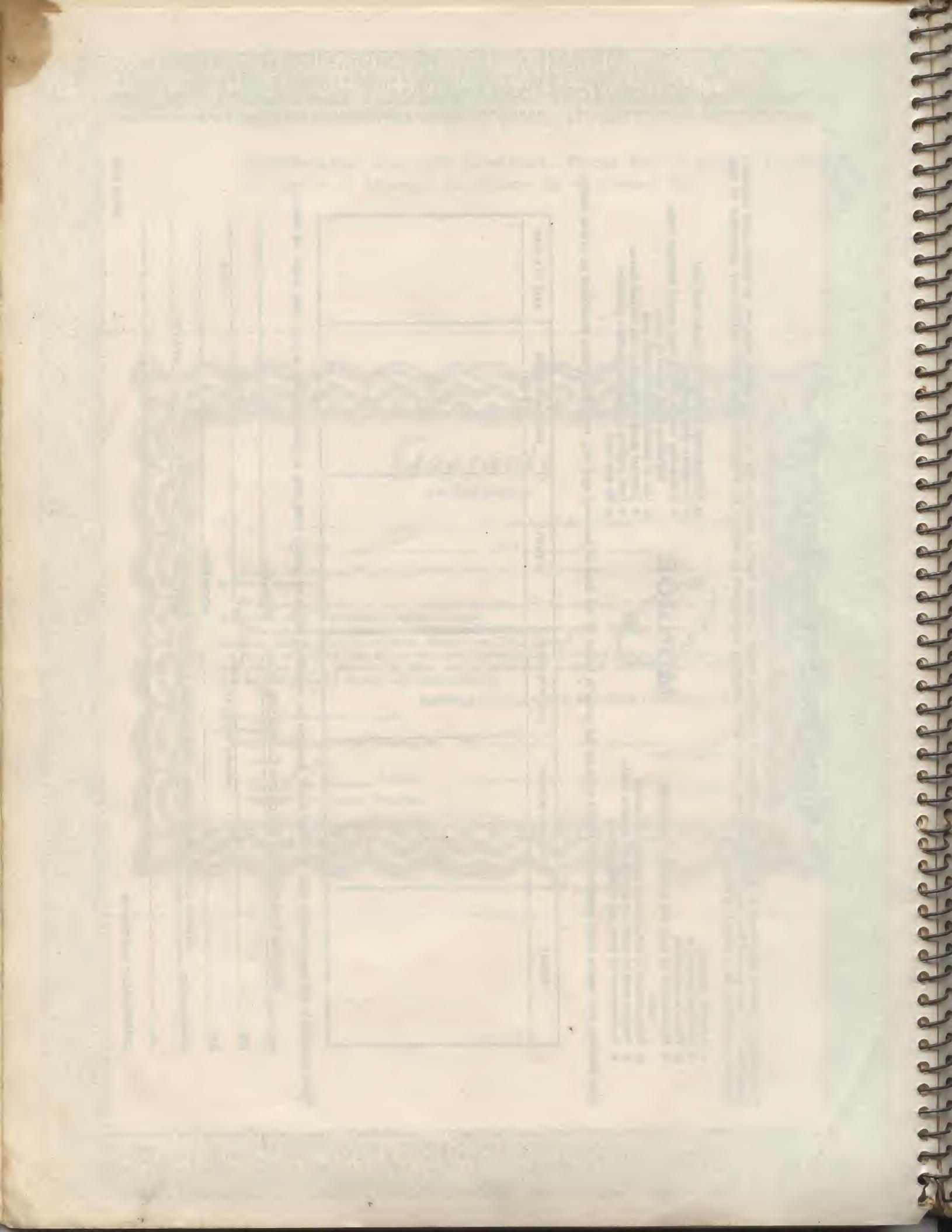
AT \_\_\_\_\_  
ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

APPROVED Monroe Calculating Machine Company, Inc.

ORIGINAL - CUSTOMER



## SERVICE FORMS

### RECORDS ARE IMPORTANT IN OUR WORK

In all phases of business and industry, paper work is required and our Branch Service Departments are no exception. To conduct our business we follow a standard Branch Office procedure governing all phases of service operation. The Branch Service Manager follows this plan of operation which requires considerable knowledge of the function of a department, types of charges, procuring supplies, equipment, handling various order forms, expense claims, etc. You will not be required to handle most of this detail. However, you will be obliged to use a few of the necessary forms such as are attached hereto. Your Service Manager will explain their use to you.





**EXAMPLE 1.**

Service Call Report, Form 930-S, illustrating preparation for a service call and completion by the serviceman.

<b>MONROE</b>			
Calculating Machine Company, Inc.			
SERVICE CALL REPORT			
Date	5/15 1957		
Name	T. L. Johnson Inc.		
Address	410 Bridges Blvd. Chesterton, Ohio		
Room No.	304	Person Calling	S. A. Jones
Nature of Trouble and Remarks		TIME RECEIVED	
ASA-10-123456		9:37	A. M. P. M.
BY FGN			
<hr/> <i>Mach. locked up.</i> <hr/> <hr/>			
Referred to	J. R. Brown		Time 10:18
Attended to by	J. R. Brown		Time 10:40
No. 38002		Signed By _____	
930-S			

**EXAMPLE 2.** Machine Repair Record, Form 461-S, illustrating preparation by a serviceman for a minor repair requiring less than one hour. Starting and finishing times are omitted and the minimum charge applies.

WHITE

YELLOW

<b>MONROE CALCULATING MACHINE COMPANY, INC.</b> <b>MACHINE REPAIR RECORD</b>			
DATE	<u>4/10/57</u> <u>210-465-212</u>		
NO.	STREET	CITY	STATE
<u>137 Pine St.</u>		<u>Syracuse</u>	<u>N. Y.</u>
<u>Fidelity National Bank</u>		<u>CITY</u>	<u>STATE</u>
<u>R.C. Campbell - Cashier</u>		<u>DEPT.</u>	<u>ROOM NO.</u>
<u>INDIVIDUAL</u>		<u>TITLE OR POSITION</u>	<u>M.</u>
<u>TIME STARTED</u>		<u>M.</u>	<u>FINISHED</u>
<b>EXPLAIN IN FULL CAUSE OF TROUBLE AND HOW REPAIRED:</b>			
<u>poor printing - carriage loose</u>			
<u>on rollers - adjust</u>			
<b>SIGNATURE OF USER</b>		<b>REPAIRED BY</b>	
<u>R.C. Campbell</u>		<u>A. Williams</u>	
<b>BY</b>		<b>REPAIRED AT</b>	
<u>Fidelity Natl. Bk.</u>		<u>Bank</u>	
<small>FORM 461-S</small>		<small>LIST MATERIAL USED ON REVERSE</small>	
<small>PRINTED IN U.S.A.</small>		<small>PRINTED IN U.S.A.</small>	

**EXAMPLE 3.** Machine Repair Record, Form 461-S, illustrating preparation for a repair requiring more than one hour, and the listing of parts on reverse side.

MONROE CALCULATING MACHINE COMPANY, INC.  
MACHINE REPAIR RECORD

DATE	<u>5/7/57</u>			MACHINE NO.	<u>LA 6-200</u> <u>456789</u>	
NO.	STREET		CITY		STATE	
<u>58 Main St.</u>			<u>Trenton</u>		<u>N. J.</u>	
<u>State Metal Products Co.</u>						
USER'S NAME		<u>J.C. Walker</u>		ACCT.		<u>205</u>
INDIVIDUAL	TITLE OR POSITION		DEPT.		ROOM NO.	
TIME STARTED	9:10 A.M.		FINISHED 10:40		A.M.	

EXPLAIN IN FULL CAUSE OF TROUBLE AND HOW REPAIRED:

Adjusted carriage shift and replaced  
motor governor and brush -  
Continuing to run at end of mult.-  
adjusted trip.

SIGNATURE OF USER	<u>State Metal Pro. Co.</u>	REPAIRED BY	<u>R. White</u>
BY	<u>J. C. Walker</u>	REPAIRED AT	<u>customers off.</u>

FORM 61-S

LIST MATERIAL USED ON REVERSE

PRINTED IN U.S.A.

WHITE

YELLOW

**EXAMPLE 4.** Service Order, Form 938-S, illustrating preparation by a serveman when used instead of Machine Repair Record, Form 461-S, on service call.

SERVICE ORDER		799271
<b>THIS IS NOT AN INVOICE</b>		
MONROE CALCULATING MACHINE COMPANY, INC.		
GENERAL OFFICES - ORANGE, NEW JERSEY		
<u>DOWNTOWN, N.Y. CSA-10</u>		<u>567890</u>
BRANCH	MODEL	SERIAL NO.
DATE <u>6/15/57</u>		
SOLD TO	<u>LIBERTY PACKING CO.</u>	
<small>PRINT DO NOT WRITE</small>		
<u>17 LIBERTY ST.</u>		
<u>NEW YORK 33, N.Y.</u>		
DEPT. OR ROOM NO.	ACCOUNTING	CUSTOMER'S ORDER NO.
		<u>NONE</u>
DESCRIPTION		
1 HOURS LABOR AT		
5.50		
PARTS USED AND DESCRIPTION OF WORK DONE		
<u>Plus &amp; minus shift key stay</u>		
<u>depressed after mult. carriage</u>		
<u>return.</u>		
<u>Replaced fractured toggle</u>		
<u>breaker arm 60-6202a</u>		
.35		
<u>Adjusted speed - cleaned and</u>		
<u>tested - O.K.</u>		
.20		
.01		
.00		
TOTAL <u>6.06</u>		
SERVICED BY	ACKNOWLEDGED	
<u>L. Kilroy</u>	<u>Liberty Packing Co.</u>	
cust. off.	BY <u>P. Lane</u>	
CUSTOMER'S SIGNATURE		
LOCATION WORK DONE		
938-S REV. 3-49		

**EXAMPLE 5.** Service Order, Form 938-S, illustrating preparation by serviceman for repairs to government owned machines.

SERVICE ORDER		835602
<b>THIS IS NOT AN INVOICE</b>		
MONROE CALCULATING MACHINE COMPANY, INC.		
GENERAL OFFICES - ORANGE, NEW JERSEY		
BRANCH	WASHINGTON D.C. CAA-10	567890
MODEL		SERIAL NO.
SOLD TO	U.S. BUREAU OF CENSUS	
PRINT - DO NOT WRITE		
<u>BUILDING #4</u>		
SUITLAND, MD.		
DEPT. OR ROOM NO.	1209	CUSTOMER'S ORDER NO.
3583		
DESCRIPTION	AMOUNT	
2 HOURS LABOR AT ZONE 2 / CALL	15.50	
PARTS USED AND DESCRIPTION OF WORK DONE		
Machine jammed -		
Replaced broken clutch yoke		
and guides. Fixed loose key-		
tops & cleaned, oiled & adjusted		
Tested - O.K.		
1 - 60-781 X 3b	1.90	
1 - 67239	.10	
1 - 67240	.10	
TRAVEL EXPENSES		
CITY TAX		
STATE TAX		
		TOTAL 17.60
SERVICED BY	ACKNOWLEDGED	
K. Jenkins cust. office	BY Edw. A. Brant	
LOCATION WORK DONE	CUSTOMER'S SIGNATURE	
938-S REV. 3-49		

**EXAMPLE 6.** Service Order Form 938-S, illustrating preparation at Branch Office from Machine Repair Record, Form 461-S, submitted by serviceman.

SERVICE ORDER		835604
<b>THIS IS NOT AN INVOICE</b>		
MONROE CALCULATING MACHINE COMPANY, INC.		
GENERAL OFFICES - ORANGE, NEW JERSEY		
<u>Newark, N.J.</u>	<u>CSA-10</u>	<u>567890</u>
BRANCH	MODEL	SERIAL NO.
SOLD TO <u>New Jersey Oil Products Co., Inc.</u>		DATE <u>6/15/57</u>
166 Snyder Ave.		
PRINT DO NOT WRITE		
Rahway, N.J.		
DEPT. OR ROOM NO.	<b>Cashier</b>	CUSTOMER'S ORDER NO. <b>None</b>
DESCRIPTION		AMOUNT
2 HOURS LABOR AT <b>5.50</b>		<b>11.00</b>
PARTS USED AND DESCRIPTION OF WORK DONE		
1 <b>60-7068x1</b>		<b>.85</b>
TRAVEL EXPENSES <b>25 miles @ .07</b>		<b>1.75</b>
CITY TAX		
STATE TAX		
		TOTAL <b>13.60</b>
SERVICED BY <b>C. Tenant</b>	ACKNOWLEDGED	
<b>R. L. Jordan, Cashier</b>		CUSTOMER'S SIGNATURE
LOCATION WORK DONE 938-S REV. 3-49		

**EXAMPLE 7.** Repair Order, Form 182-S, illustrating preparation, approval and acceptance. Duplicate copy of Shop Ticket, Form 799-S, is attached. See Example 8.

**MONROE CALCULATING MACHINE COMPANY, INC.**  
**REPAIR ORDER • NOT AN INVOICE**

MODEL	AA1-213	BERIAL NO.	367539	DATE	6-15-57
USER'S NAME	J. B. Barrett Stamping Co.				
ADDRESS	674 Newcomb St.	CITY	Providence 5	STATE	R. I.
DEPARTMENT OF USER'S PLANT OR OFFICE WHERE MACHINE IS LOCATED Engineering Dept.					
ADDRESS	DITY	STATE			
LABOR	13 hours				
TRAVEL EXPENSE <input type="checkbox"/>	EXPRESS CHARGES <input type="checkbox"/>	Delivery			
COST OF REPAIR PARTS					
TAX (EXPLAIN) 2% State Tax .54					
TOTAL 102.14					
LIST REPAIR PARTS BELOW					
<i>APPROVED 6/17/57 NORTHEASTERN DIVISION J. B. BY J. B.</i>					
CHARGE FOR THIS SERVICE IS IN ORDER BECAUSE: (PLEASE CHECK)					
<input checked="" type="checkbox"/> GUARANTEE HAS EXPIRED	<input type="checkbox"/> MACHINE ACCIDENTALLY DAMAGED	<input type="checkbox"/> MACHINE PURCHASED SECOND-HAND	<input type="checkbox"/> MACHINE DAMAGED BY FIRE		
SIGNED	J. R. Boyd		APPROVED BY	L. R. Nesbitt	
BRANCH	Providence, R. I.		TERRITORY OF	M. R. Colt	
MANAGER 23					
BRANCH ZONE NO. 23					
<b>USER WILL PLEASE FILL IN AND SIGN</b>					
<b>MONROE CALCULATING MACHINE COMPANY, INC.</b>					
YOU ARE AUTHORIZED TO PROCEED WITH THE REPAIRS ACCORDING TO THE ABOVE ESTIMATE.					
WE REQUIRE	2 COPIES OF INVOICE	CONFIRMING ORDER:	<input type="checkbox"/> IS ATTACHED	<input checked="" type="checkbox"/> WILL FOLLOW	<input type="checkbox"/> NOT NECESSARY
OUR CONFIRMING ORDER NUMBER IS					
SIGNED BY	H. R. Devlin		TITLE	Mgr. - Eng. Dept.	
BARDI INC., DEEP RIVER, CONN.					
ORIGINAL - TO ORANGE					

**EXAMPLE 8.** Shop Ticket, Form 799-S, illustrating preparation by serviceman when examining a machine for a repair estimate.

## SHOP TICKET

Machine No. AA1-213  
367539

Name JB. Barrett, Stamp  
Address 674 Newcomb St.  
City  
Dept. Engineering  
Purchase Date 4/16/41  
Cost to Date \$ 146.35

\$ \_\_\_\_\_  
\_\_\_\_\_  
\$ \_\_\_\_\_

Amount of Estimate \$ 102.14

Completed by J. V. Boyd  
Serviceman

799-S

Date 6/15/57

Part No.	Unit	Total
40-795	/	2.90
40-792	/	.15
40-793	/	.35
289644	/	1.15
57993	/	1.15
58-781	/	1.15
538024	/	.40
59041a	/	.30
58-6322	/	.25
58-6321	/	3.40
58-7409	/	1.15
58-7246x2	/	3.80
68-6005	/	3.70
30-726	/	6.85
LM-40	/	27.10

Labor \_\_\_\_\_ \$ 71.50  
Delivery \_\_\_\_\_ \$ 3.00  
Tax \_\_\_\_\_ \$ .52

**EXAMPLE 9.** Service Car Expense Report, Form 1114-S. See General Notice No. 330 of October 15, 1955 and November 18, 1955. Service Travel and Subsistence Report is on reverse side. See Example 10.

**EXAMPLE 10.** Service Travel and Subsistence Report, Form 1114-S. See General Notice No. 330 of October 15, 1955 and November 18, 1955.

## OUR PLANTS

### THE WORKERS IN THE FACTORIES RELY ON THE MAN IN THE FIELD

"The pursuit of an ideal in a human way" has resulted in the sound growth of the Monroe Company.

The Monroe Calculating Machine Company employs approximately 5,500 persons. The main factory and general offices are located in the city of Orange, New Jersey; and there are plants in ~~Morris Plains, New Jersey~~; Bristol, Virginia; and in Amsterdam, Holland.

The majority of the parts and assemblies used in Monroe Calculating, Listing, Accounting, and Checkwriting machines are manufactured at the Orange Plant. The facilities of the other factories are used mainly for assembling the various models of our machines.



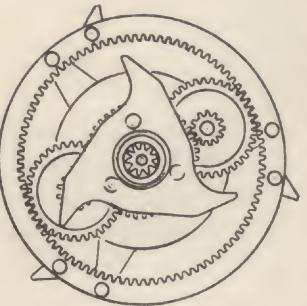
Requirements of the Field Service Organization are handled at Orange by the General Service Department. It is here that all matters related to servicing customers' machines are considered, and acted upon by a competent staff of experienced service engineers and technicians. Through the medium of this department, the serviceman has at his disposal, not only the department's service skills, but also the talents and know-how of the Company's Engineering, Research, and Quality Control Departments -- whenever needed.

The General Service Personnel have many means of liaison with the hundreds of servicemen located in all parts of the nation. Correspondence plays a very large part in the interchange of questions, answers, requests, and notices. Telephone, teletype, and telegraph are used daily also. Personal meetings via visits of General Service Department personnel or by their Division Representatives serve as another medium. Orange and Division Schools are conducted to which servicemen are brought to learn, first-hand, the working of certain models. One of the older and valuable liaison mediums upon which Field Service Departments rely for ready reference is the service literature issued by the General Service Department. This literature comprises Machine Service Bulletins, Parts Catalogs, Parts Improvement Notices, Special Service Letters, Service Manuals, and a serviceman's magazine known as Orangeaids. Many hundreds of such publications have been compiled and made available to Service Depart-

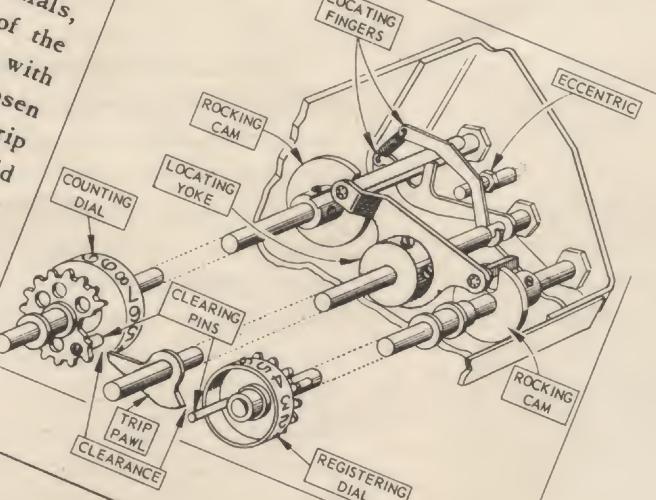
ments to aid and guide servicemen in dismantling, adjusting, lubricating, and testing machines.

One of the larger sections of the General Service Department at Orange is the Graphic Engineering and Publications Unit where competent Graphic Engineers study Monroe products and, combining their knowledge with data gathered from many varied sources, compile the books and manuals which are used by field servicemen. The Monroe Company has many "firsts" of which they are proud, and among them is the medium employed to illustrate the mechanism of our machines.

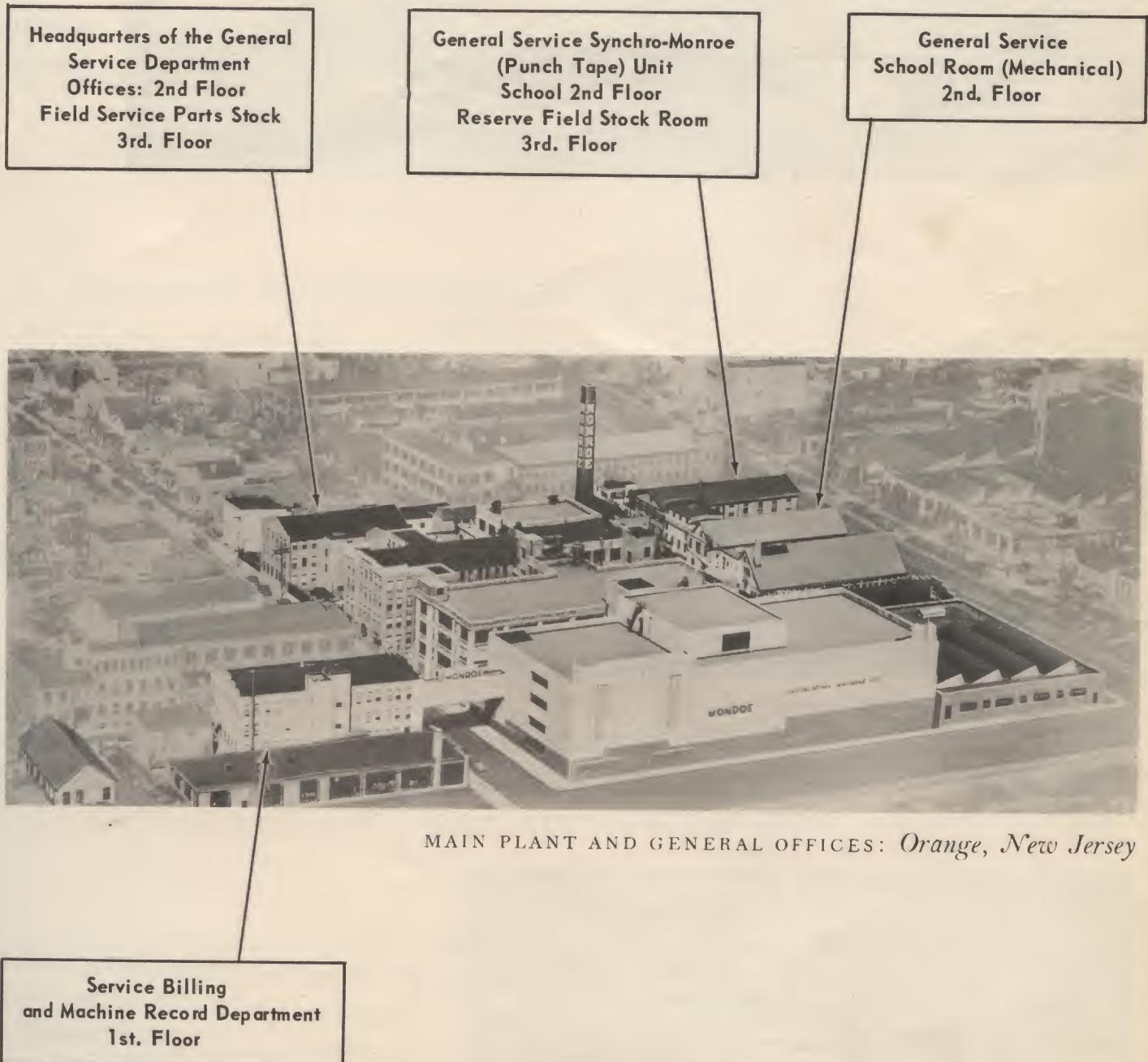
The Field Service Parts Unit of General Service stocks and supplies all the requirements of the field for the repair and maintenance of customers' machines.



Set trip rod for clearing of dials. Set eccentric stud in L.H. end of carriage so that the locating yoke stud for counting yoke seats in the slot of the counting dial cam with almost a full hold. Loosen set screws in hub of trip rod locating yoke, hold yoke securely and move trip rod to obtain equal clearance between trip pawl and clearing pins. Tighten yoke screws securely.



## MONROE MANUFACTURING PLANTS - HERE AND ABROAD



... A Product Which Has Changed the World

Is Assembled In These Plants . . .



BRANCH PLANT  
*Morris Plains*  
*New Jersey*



BRANCH PLANT  
*Bristol*  
*Virginia*



BRANCH PLANT  
*Amsterdam*  
*Holland*

*Latest tools, equipment,  
and methods are used  
in the manufacture  
of Monroe machines*

SECTION **H** QUESTIONNAIRE

STUDENT \_\_\_\_\_ BRANCH \_\_\_\_\_ DATE \_\_\_\_\_

ORANGE EXAMINER \_\_\_\_\_ RIGHT \_\_\_\_\_ WRONG \_\_\_\_\_

1 Q. Where are the majority of machine parts manufactured?

A. ORANGE PLANT

2 Q. How many people are employed by the Monroe Company?

A. 2 5501

3 Q. What Department at Orange handles service matters?

A. GENERAL SERVICE DEPT.

4 Q. What are the mediums of contact between Orange and various service departments in the field?

A. CORRESPONDENCE BY MAIL TELEPHONE TELEGRAPH  
PERSONAL CONTACT

5 Q. How many plants does the Monroe Company have?

A. ✓

6 Q. How many different types of publications are available to service departments to aid men like you in daily service work?

A. 6

7 Q. What Orange Department provides field service requirements?

A. GENERAL SERVICE DEPT.



## AN INTRIGUING PRODUCT

### THE MODERN CALCULATOR -- A CHALLENGE TO MECHANICAL ABILITY

The office equipment industry has grown rapidly since Frank S. Baldwin invented his machines and joined forces with Jay R. Monroe. Today there are many styles of calculating and adding machines being manufactured in this country and abroad. They are produced in all shapes, sizes, and colors, operate in varied ways and sell for different prices. All of these machines can be traced back to the inventive genius of a few men of varied nationality who, unknown to each other, designed and assembled working models.

We feel certain that you will join others of us in the industry in becoming fully appreciative of the wonderful inventive and engineering skill and effort that is required to produce a calculator, and recognize the blessing it has been to the world at large. We know it has freed mankind from the drudgery of mental computing, saved incalculable hours of time, transformed the appearance of offices, given birth to a myriad of related and dependent business machines and changed a method of primary education; i. e., arithmetic.

The Monroe sales and servicemen must continually present the merits of our products to the public. One of the outstanding advantages of purchasing Monroe machines is the high quality of service that we have always furnished. You have become a part of this fine service organization and you will be called upon to install, repair, and maintain our machines. You will be closer to the users of our products than anyone else in the Monroe Company; therefore, you will have the best opportunity to sell Monroe to them through quality "service".



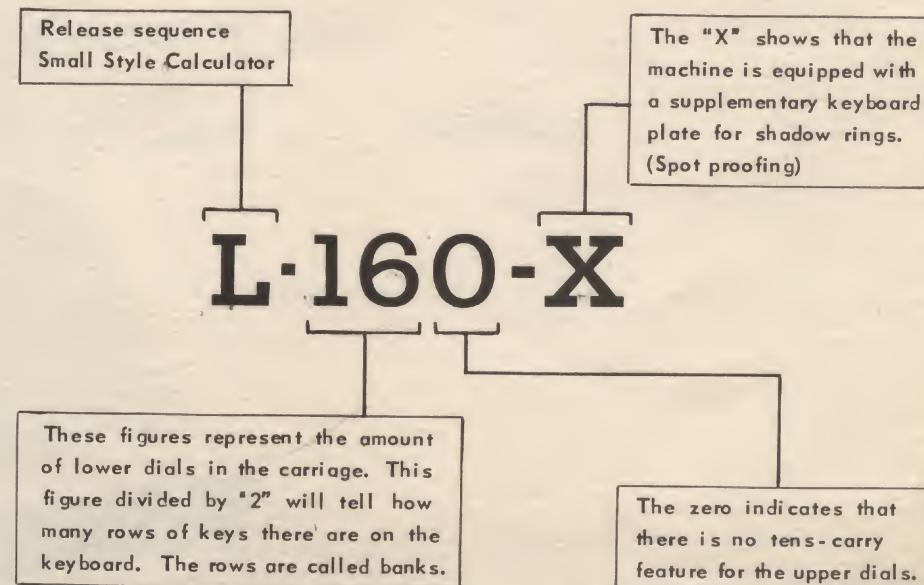
## CODING

### WHAT DO THE SYMBOLS MEAN?



Before we proceed further into the workings of the Monroe Calculator, let us pause for a while and discuss first things first. What do the letters and numbers L-160-X represent as a model designation? The "L" is an alphabetical sequence code and indicates the model to be an early one. The letters A, B, C, D, E and F are lost in the records of those early days devoted to constructing a suitable pilot model. The "G" model was the first machine of the refined style and some are still in use in customers' offices today. The "H" and "I" were never released for production, but the "K" was the real start of the big forward march by the Monroe Company. The "K" hand machine was followed by KA, KAS, KAA, KASC, KASE, etc. -- machines all more fully automatic than the former. The "L" model introduced the small, compact, "executive" style calculator to the business world. Its convenient dimensions, weight and portability caused it to become very popular and widely used by executives and accountants. It may be seen in use in planes in flight and suspended from the shoulders of inspectors in the holds of freighters passing through canals where tolls are computed based on cargo load.

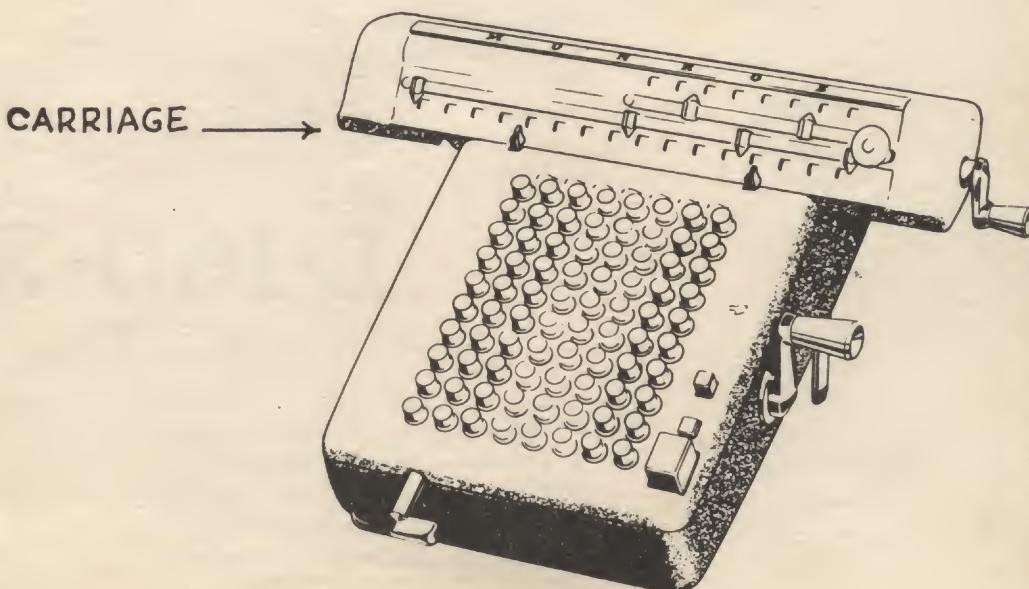
From the foregoing, we now have learned what the "L" represents. Now, let us see what the grouping of numerals indicates.



The carriage of a calculator slides sidewise on and with a rod known as the "hinge" rod. This rod also allows the carriage front to be raised and lowered (pivoted) freely. Dials (wheels on which numerals are imprinted) are located within windows of the carriage and are aligned with the banks (row) of keys on the keyboard from which the dials will be actuated. The carriage must be set in proper relationship to the base mechanism by depth (upward or downward and also forward or rearward and left and right).

The dictionary definition of the word "carriage" reads: "A part of a machine which moves and supports some other moving part". The word "carriage" is common to office equipment. Typewriters have a main moving member known as the "carriage", and accounting (bookkeeping) machines also have "carriages." These shuttling typewriter and bookkeeper "carriages" bring sheets or rolls of paper into alignment with printing type faces which will print through a ribbon onto the paper. On calculators, however, the "carriage" serves only to align the dials with the particular keyboard keys to be operated in a specific application (operation or problem). Calculator carriages do not use paper, but instead, give answers by presenting dial figures to the eye.

The carriages of the L-160-X calculators has 8 upper dials and 16 lower dials. These lower dials are displaced (moved) by gears in the base of the machine and the upper dials counting finger (a moving steel part driven by an eccentric cam on the machine main carry shaft.)



SECTION **K** QUESTIONNAIRE

STUDENT \_\_\_\_\_ BRANCH \_\_\_\_\_ DATE \_\_\_\_\_

ORANGE EXAMINER \_\_\_\_\_ RIGHT \_\_\_\_\_ WRONG \_\_\_\_\_

1 Q. What do the letters and numbers L-160-X represent?

A.

*L-160-X*  
*NO TERM*  
*FACTORY*  
*SUPERVISOR*  
*BY DAY*

2 Q. If a machine has 10 columns or "banks", how many lower dials will it contain?

A.

3 Q. What is the hinge rod?

A.

4 Q. What is the carriage?

A.

5 Q. What is the purpose of the carriage?

A.

6 Q. What actuates (drives) the lower (registering) dials?

A.

7 Q. What actuates (drives) the upper (counting) dials?

A.



## THE PRODUCT

The Monroe Calculator: -- It adds, subtracts, multiplies, and divides easily and quickly and is simple to operate.

\* \* \* \* \*

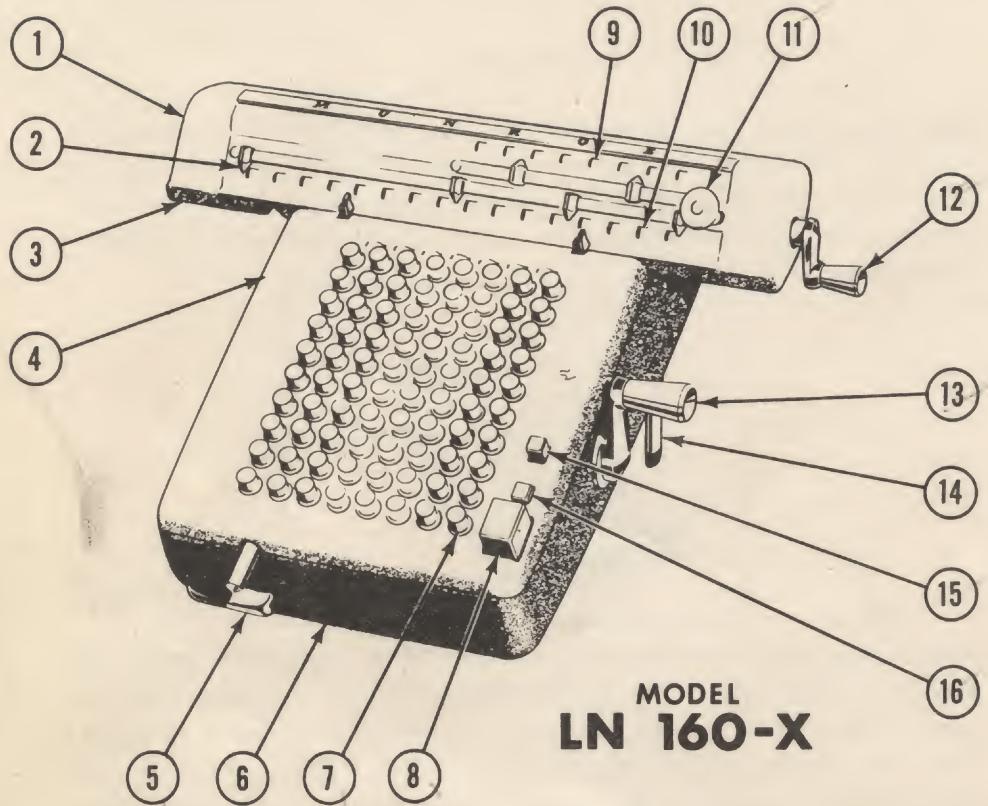
The smallest of the Monroe Calculators is the LN 160-X, a picture of which is shown below. This machine is the first with which you will become acquainted inasmuch as its mechanical principle is common to all other Monroe Calculators.



After you have mastered this machine, you will study the LA-5 model and move step-by-step into the fully-automatic machines. We would, however, point out here and now that the servicing of an L-160 (or LN-160) is just as important as repairing the most fully automatic calculator. Thoroughness, care, and thought must be exercised in servicing any Monroe product. The customer's investment must be protected by prompt, accurate service so that his machine is not idled by mechanical failure or by repeat calls. Know your machines. You will receive a thorough understanding of all models in a planned, easy, step-by-step method which should prove very interesting and challenging to you. You will later be studying Monroe service literature prepared for Senior Servicemen, and to get the most from it, you must be familiar with the language we use.

The Monroe Calculator is encased within a carriage shell, cover case, and bottom pan. These serve several purposes such as improved appearance, protection of fingers from mechanism, and the keeping of dust and foreign matter out of the mechanism. The machine itself is composed of two main sections; namely, the Base and the Carriage. The major units of the base are side and cross frames, selecting gear shaft, wedge shaft, carry shaft, selecting bails, and keyboard. The major units of the carriage consist of a shell, lower dial shaft, upper dial shaft, lift cam shaft, trip rod, hinge rod, clearout gears, and crank.

## PRINCIPAL EXTERIOR FEATURES



1. CARRIAGE	9. COUNTING DIALS (UPPER)
2. DECIMAL MARKER	10. REGISTERING DIALS (LOWER)
3. CARRIAGE LOCK LEDGE	11. CARRIAGE LIFT KNOB
4. SUPPLEMENTARY KEYBOARD PLATE	12. CARRIAGE CLEAROUT CRANK
5. CARRIAGE SHIFTER HANDLE	13. MACHINE CRANK
6. COVER CASE	14. FOLDING LEGS
7. NUMERAL KEYTOPS	15. NON-REPEAT KEY
8. CLEAR KEY	16. REPEAT KEY

Calculating is accomplished on "L" model machines through the turning of the machine hand crank in either a clockwise or counter-clockwise direction with one or more numeral keystems depressed in the keyboard. Addition and multiplication are accomplished by turning the crank clockwise and subtraction and division by turning the crank counter-clockwise. This simple reversible rotary action is the principle underlying the operation of every Monroe Calculator.

SECTION L QUESTIONNAIRE

STUDENT \_\_\_\_\_ BRANCH \_\_\_\_\_ DATE \_\_\_\_\_

ORANGE EXAMINER \_\_\_\_\_ RIGHT \_\_\_\_\_ WRONG \_\_\_\_\_

1 Q. What is the smallest model calculator?

A.

2 Q. What encloses this machine?

A.

3 Q. What are the purposes of this enclosure?

A.

4 Q. What are the two main sections of the machine?

A.

5 Q. What are the major units of the base?

A.

12

6 Q. What are the major units of the carriage?

A.

12

7 Q. Name the visible exterior items used to operate the machine?

A.

8 Q. How is calculating accomplished?

A.

## WHAT'S IN A NAME?

接した plunger を押せしめ、(2) #2 と  
failure (外れ) 最端の位置と二番目、九  
trip pawl の中の plunger が shift  
stop の低い縁に接して、上へ動かされ  
ing を後へ妨げるため tabulator stop  
事が必要である。

Quite a bit of importance. We have our own language  
which servicemen must learn.

If you have ever travelled in a foreign land, the language  
of which you could not speak or understand, you know  
what it feels like to be left without conversation. This is,  
no doubt, the same way you feel now as an apprentice  
serviceman as you read our Monroe part names and func-  
tion descriptions. It is natural to feel so, but you will  
soon become well acquainted with our Company, its pro-  
ducts and our business language.

The Monroe Calculator is a machine which requires, on  
hand models such as the L-160-X, the turning of a crank  
in order to put the various gears and related moving parts  
into motion.

The (full) rotary members of this model are:

- A. The selecting gear shaft
- B. The main carry shaft
- C. The dial shafts of the carriage
- D. The individual dials
- E. R. H. side gear train
- F. Shifter - Operating handle - Dial clearout crank

The non-revolving sections are:

- 1. The wedge shaft (intermediate gear shaft)
- 2. Selecting bails
- 3. Keyboard
- 4. Cross members
- 5. Side frames
- 6. Tie rods
- 7. Carriage
- 8. Cover case
- 9. Bottom pan
- 10. Carriage locks
- 11. Supplementary keyboard plate
- 12. Keytops
- 13. Decimal bars
- 14. Decimal markers

番目の位置との間に止まる。  
key を押している間 tabulator  
る時、shift trip pawl の cam-  
の下の extension を上へ曲げる

Other parts used in this machine are identified with the following names:

1. Carry dog	12. Carriage crank
2. Subtract dog	13. Machine crank
3. Selecting gear	14. Master clear button
4. Check pawl	15. Repeat key
5. Feet	16. Non-repeat key.
6. Check spring	17. Lever
7. Wedge spring	18. Knobs
8. Folding legs	19. Pins
9. Bell	20. Nuts
10. Trip lever	21. Screws
11. Lock ledge	22. Decalcomanias (Decals)

Part names are derived through several means, but the majority are received from their usage in the machine. The "keyboard decimal marker" is just what its name implies -- the decimal marker for the keyboard. The "carriage locks" lock the carriage downward while the machine is turning figures into the dials. There are, however, such parts as the carry "dogs" of the main shaft and the gear "train" of the right-hand side that received their names from other sources. The "dog" is a sidewise sliding member used to effect a tens-carry movement. When held in one position, the early 'L' model sliding member profile took on the appearance of the animal.

In the electric model, we have parts long known officially as the "spider" gear, the "duck" arm, the clutch "yoke", etc. In these instances, the appearance of the part caused it to become known by its profile rather than by the parts usage.

It is important to know, recognize, and describe Monroe parts and assemblies by their correct names. Page 3-M illustrates a sample page from the LN-160-X parts catalog showing one-noun and part number designations. Note how the parts are drawn so that the page serves as an assembling guide.



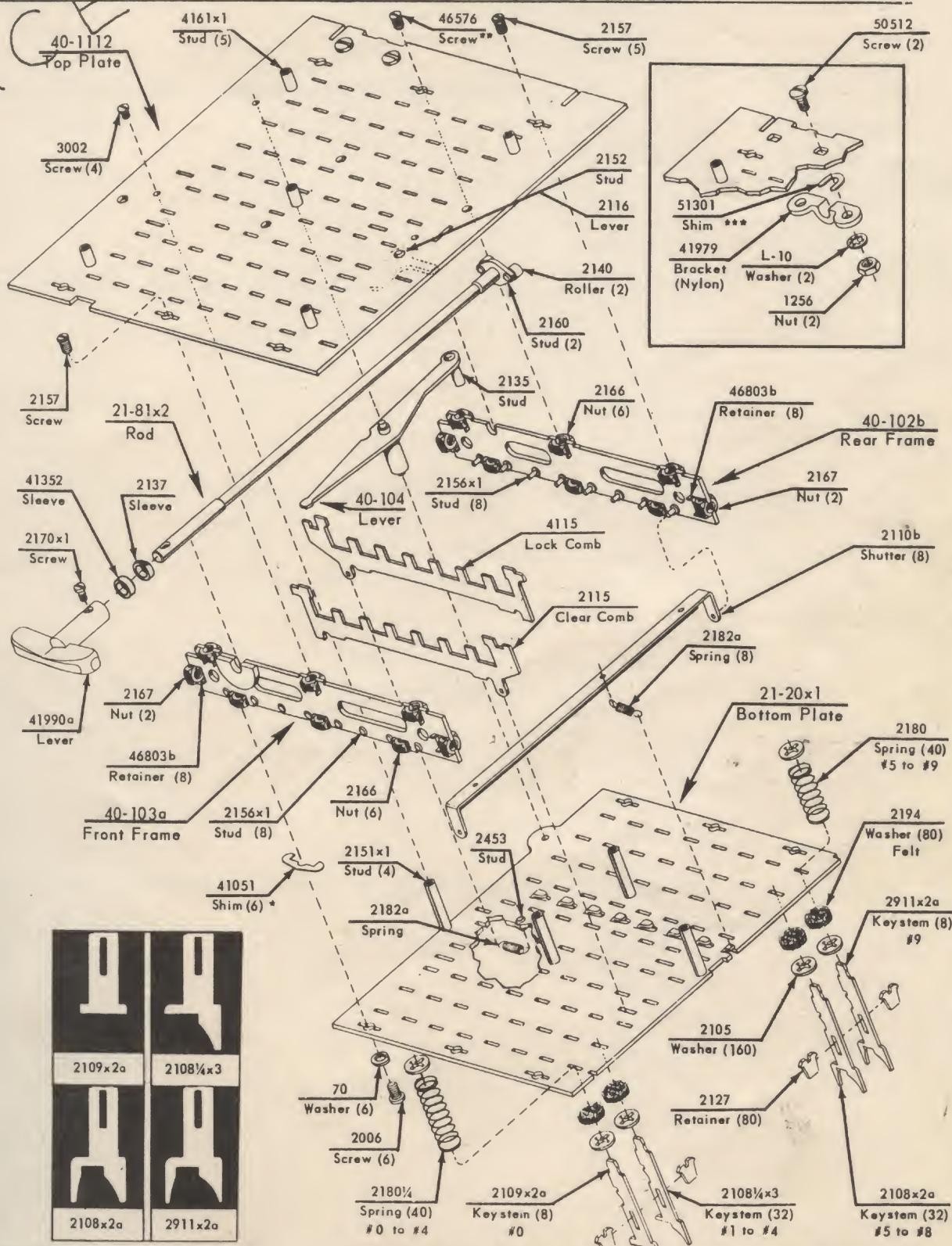
The General Service Department at Orange provides the Field Service Organization with various kinds of printed technical publications such as:

1. Parts and Price Catalog
2. Service Manuals
3. Machine Service Bulletins
4. Parts Improvement Notices
5. Orangeaids (The Serviceman's Magazine)
6. Special Service Letters

C.S.B. #L-509

KEYBOARD

PAGE 9



\* Used only when necessary (to secure proper locking down of keystems.)

LN-160-X PARTS CATALOG

\*\* Used in top front center holes to provide clearance for decimal markers.

\*\*\* Amount used may vary



SECTION (M) QUESTIONNAIRE

STUDENT \_\_\_\_\_ BRANCH \_\_\_\_\_ DATE \_\_\_\_\_

ORANGE EXAMINER \_\_\_\_\_ RIGHT \_\_\_\_\_ WRONG \_\_\_\_\_

1 Q. How is the L-160-X model operated?

A.

2 Q.<sup>14</sup> What units of this model revolve?

A.

1M

3 Q.<sup>14</sup> What are the non-rotating sections?

A.

1 m

4 Q. How do parts receive their names?

A.

2 m

5 Q. Do our catalogs serve as an assembling guide also?

A.

6 Q. Who provides the service bulletins?

A.

7 Q. Name 6 service publications.

A.

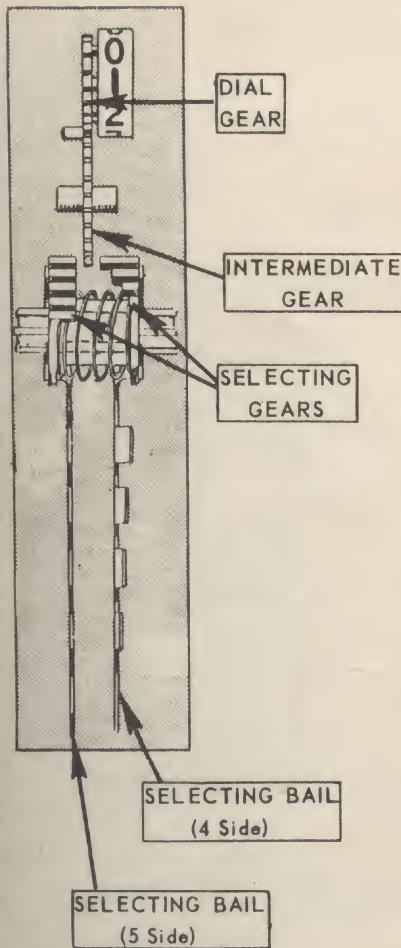
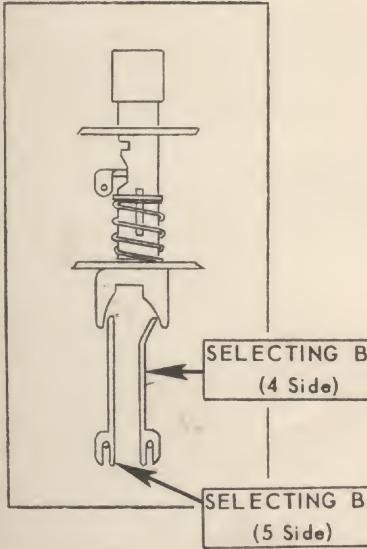


## SEQUENCE OF MOVEMENTS

### SELECTION AND CARRY OVER PRINCIPLE

See Page 3-N

The selector bails of which there are two types, namely "four-side" and "five-side", rest on pivot studs (J), and when in neutral position stand upward due to the action of selector gear springs (H) holding the selector gears apart, in their neutral positions on the splines of the shaft. When the selector gears are apart in neutral position, the machine can cycle without displacement of the registering dials. The counting dials, however, will register each cycle of the machine regardless of the selector gears position. The depression of a numeral keystem of the keyboard will cause either a "four-toothed" or a "five-toothed" selector gear, or both, to move toward the other a limited distance until the operative bail lug comes to rest in a notch in the bottom of the keystem. The angle of the lug on the selector bail determines how far the selecting gear will be moved sidewise when the keystem is depressed. The desired alignment of the selector gear teeth in relation to the intermediate gear is a  $3/4$  engagement of the intermediate gear teeth. If the alignment is "shy", the angle of the lug should be increased as shown in Figure 1. If the alignment, however, is "too-full", the angle should be decreased as shown in Figure 2. The two extensions (F) of the bails should engage the selector gear simultaneously to prevent a bind in the sliding of the gear. For each column of keystems there is a pair of selecting bails beneath; one a "four-side" bail and the other a "five-side" bail. Keystems 1 to 4 actuate only the "four-side" bail, keystem 5 engages only the "five-side" bail and keystems 6 to 9 engage both bails. NOTE: The end play of the complete selecting shaft is controlled by turning the knurled cap on the L. H. end of the shaft with the fingers to obtain a minimum shaft end play movement without causing the shaft to bind.

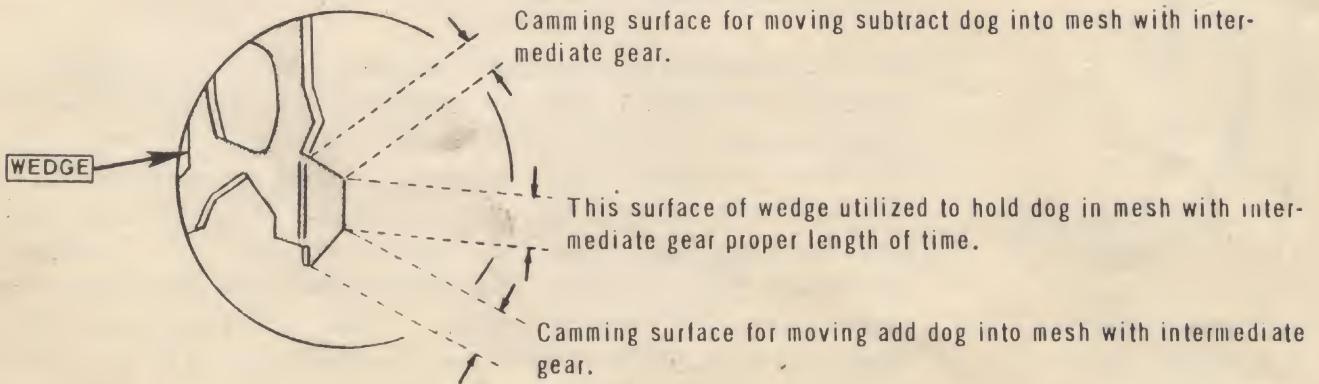


The depression of numeral keystem, digit "5" (Figure 1), causes a camming surface on the bottom of the keystem to engage a lug (G) on a "five-side" selecting bail and pivot the bail inward on pivot studs (J). Two extensions (F) of the bail rest against the outer surface of a selecting gear and through this pivoting motion causes the 5 toothed selecting gear to slide into alignment with the intermediate gear of the wedge shaft. The selecting gear presents its five teeth to the intermediate gear (E) when the machine cycles.

When any keystem below digit "5" is depressed, a lug on a "four-side" bail is engaged pivoting the bail inward which in turn aligns the 4 toothed selecting gear with the intermediate gear. The selecting gear engages one to four of its teeth, corresponding to keysystems depressed in the keyboard, when the machine cycles.

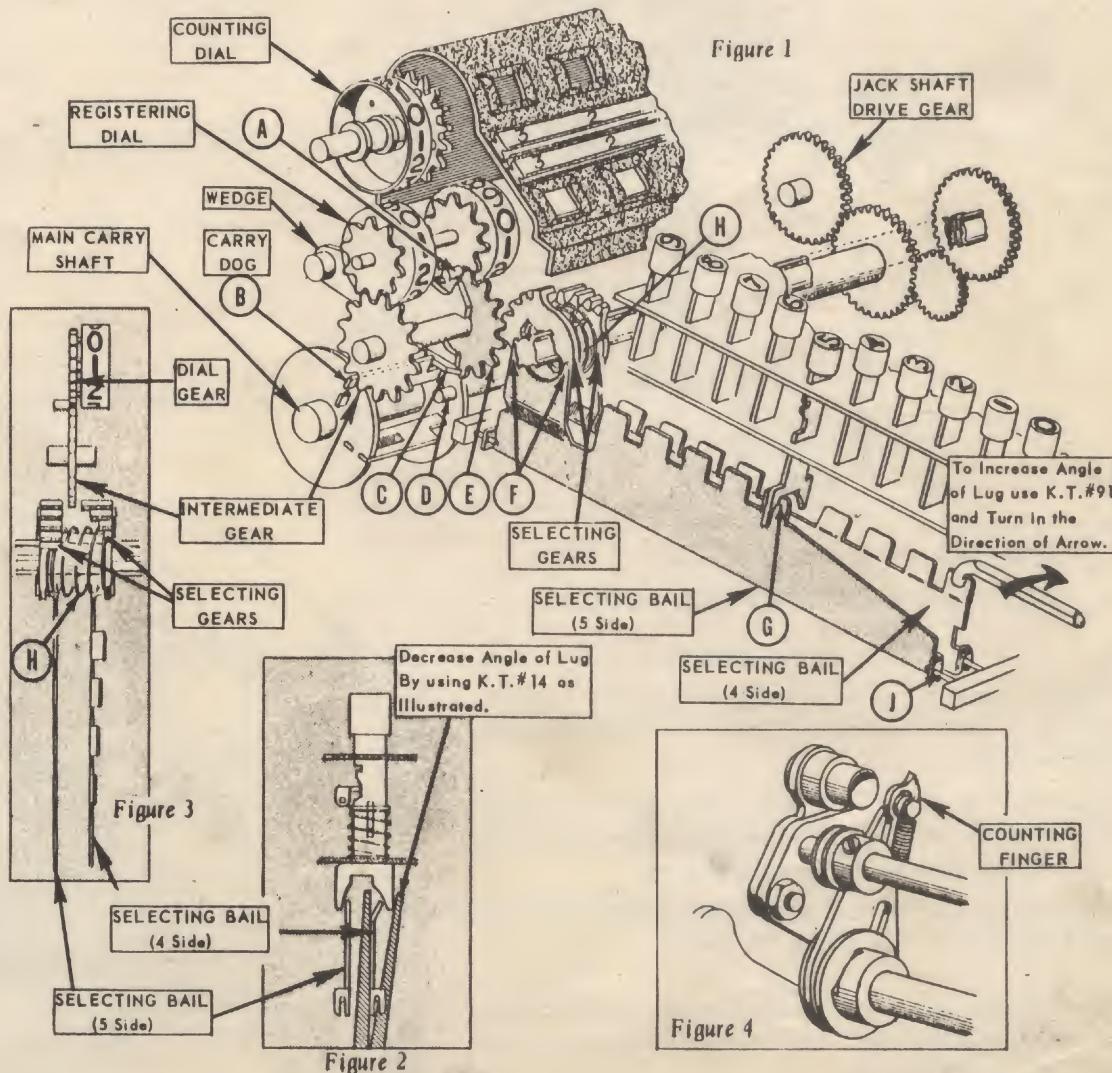
When any keystem above digit "5" is depressed, both camming surfaces on the bottom of the keystem engage lugs of both "four-side" and "five-side" bails. This causes both four toothed and five toothed selecting gears, held in position by spring (H), to be aligned with intermediate gears of the wedge shaft. Six to nine teeth of the selecting gears are engaged with the intermediate gear when the machine cycles.

Due to the gear of the registering carriage dial being in mesh with the intermediate gear when the carriage is locked downward in position, the turning of the selecting gears will cause a tooth displacement of the registering dial corresponding to the keystem numerals depressed on the keyboard. Therefore, rotation of the machine crank with a "2" on the keyboard should result in a "2" appearing in the registering dial window of the same column and a "1" in the counting dial. The counting dial count is obtained through use of a counting finger driven from the carry shaft. If the machine is again cycled in plus, a "4" should appear in the registering dial and a "2" should appear in the counting dial. If the machine is cycled minus with keyboard keys depressed and with a factor set in the registering dials, a subtraction would occur equal to the digits depressed in the keyboard. In other words, if "4" appears in a registering dial and a "2" is set in the keyboard and a minus rotation is made, it will cause a "2" to be subtracted from the registering dial "4".



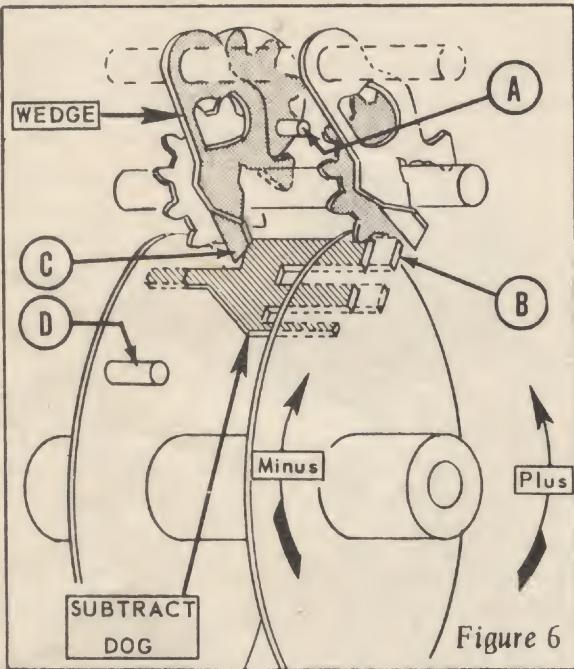
When the "9" of a registering dial is displaced by a "1" through the medium of selector, intermediate and dial gears, a stud (A) on the gear of the registering dial engages a wedge in the same column and causes it to become depressed. After the wedge is depressed, the turning of the carry shaft causes a carry dog to cam sidewise due to engagement with the foot (C) of the wedge, thereby moving the upper lug (B) of the carry dog into mesh with the next higher order intermediate gear (to the left of the active columns) displacing the gear one tooth, which will result in a registering dial reading of "10". Immediately following this carry-over, a stud (D) on the carry shaft restores the wedge to its upward neutral position.

While the registering dials are thus being operated, the counting dials are moved through the use of a counting finger which operates in an eccentric stroke during each rotation of the carry shaft. See Figure 4.



## TENS CARRY ACTION

The subtraction of "1" from "10" is accomplished by turning the handle in minus. When this is done, a stud (A) on the registering dial engages a wedge in the same column and causes it to become depressed and held thereby by spring action. After the wedge is depressed, the turning of the carry shaft in the minus direction causes the subtract dog to cam sidewise (as did the add dog). This camming is due to engagement with the foot (C) of the wedge thereby moving the upper lug (B) of the subtract dog into mesh with the adjacent intermediate gear toward the left displacing the gear one tooth which will result in a registering dial reading of "9". Immediately following this, a stud (D) on the carry shaft restores the wedge of its upward neutral position where it is held by the wedge spring.



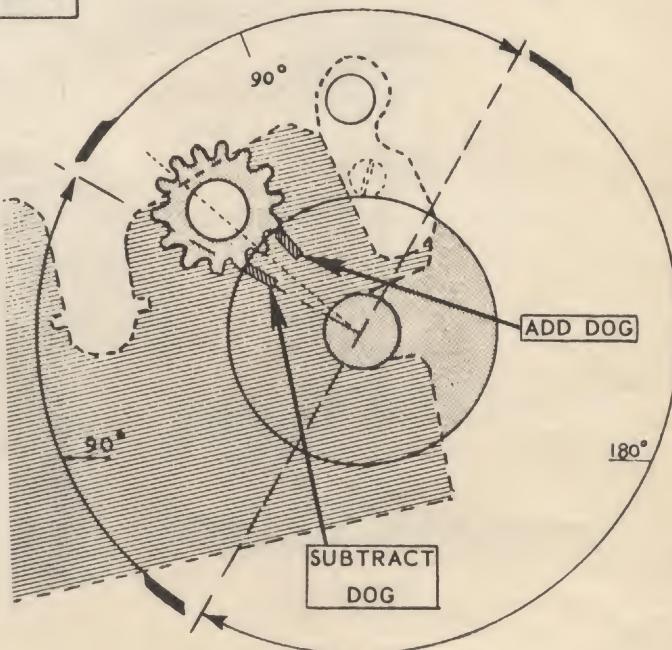
### SEQUENCE OF EVENTS RELATIVE TO SELECTION AND CARRY DOG ACTION

Approximately  $90^\circ$  of the addition calculating cycle is utilized to move the subtract dogs away from the intermediate gear.

Approximately  $180^\circ$  of the calculating cycle is utilized to provide an inactive dog zone during movement of the intermediate gear by the selecting gears.

Approximately  $90^\circ$  of the calculating cycle is utilized to permit the add dog action if required.

This illustration and explanation covers the clockwise, addition dog movement. The subtract dog movement is the reverse of the above.



SECTION (N) QUESTIONNAIRE

STUDENT \_\_\_\_\_ BRANCH \_\_\_\_\_ DATE \_\_\_\_\_

ORANGE EXAMINER \_\_\_\_\_ RIGHT \_\_\_\_\_ WRONG \_\_\_\_\_

1 Q. When can the machine cycle without causing the registering dials to turn.

A.

2 Q. Do the counting dials depend on the selector gears for driving action?

A.

3 Q. What determines how far the selector gear will be moved sidewise?

A.

4 Q. What is a "four-side" bail?

A.

5 Q. How does a "9" plus "1" become "10" in the registering dial?

A.

6 Q. What three functions does the offset foot of the wedge serve?

A.



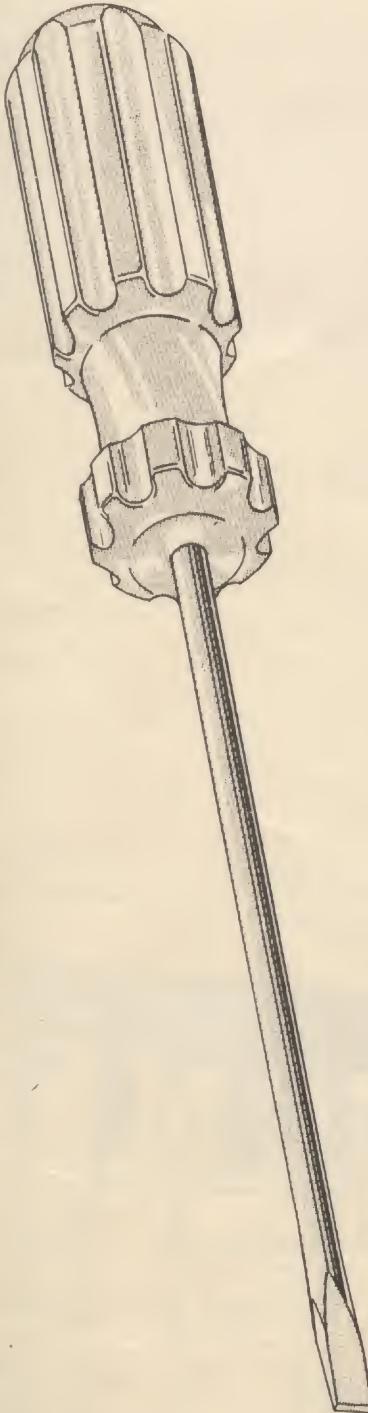
## TOOLS OF THE TRADE

As a serviceman for Monroe, you will be provided with a set of Monroe Kit Tools, some of which are in general usage and others of special Monroe design. They will enable you to adjust the mechanism of Monroe machines.

Because of the small sizes of our products and the confined areas in which you are required to insert, remove or adjust parts, we have designed and utilized special tools.

These tools are identified on requisition as "K. T." which indicates Kit Tools. Some of these, used most frequently to service our "L" calculators and which you will use are as follows:

KT 1	Hammer, Ball Peen
KT 2	Screwdriver, Split Nose 9/64" Blade Tip Width
KT 4	Screwdriver, 6" Shank x 3/16" Blade Tip Width
KT 11	Brush, Cleaning, Bristle Length 2", Width 1"
KT 12-A	Oiler, Plastic, Circular Flat
KT 14	Pliers, 6-1/4", Duck Bill
KT 17	Pliers, 4-1/4" Wedge Spring
KT 20	File, 6-1/4" #0 Square Needle
KT 21	File, 6" #0 Flat Needle
KT 25	Tweezers, 4"
KT 29	Punch, 3/16" Diameter Pin
KT 35	Inserter, Wedge Spring
KT 66	Wrench, 1/4" Hexagon Socket
KT 67	Screwdriver, 6" Shank, 1/8" Blade Tip Width (for Governor Set Screws)
KT 68	Punch, Aligning for Taper Pins
KT 69	Punch, Aligning for Small Taper Pins
KT 91	Bender, L and M Models Selecting Bail Lug (Front Entry)
KT 92	Wrench, 1/4" Open End
KT 118	Bender, for Selecting Bail Swivel
KT 126	Bender
KT 135-A	Brush, Flat Cleaning
KT 143	Pliers, 6" Thin Locking (Hemostat)
KT 177	Wrench, Open End 5/32" x 3/16"
KT 181	Wrench, Open End 1/4" x 3/16" 65 degrees

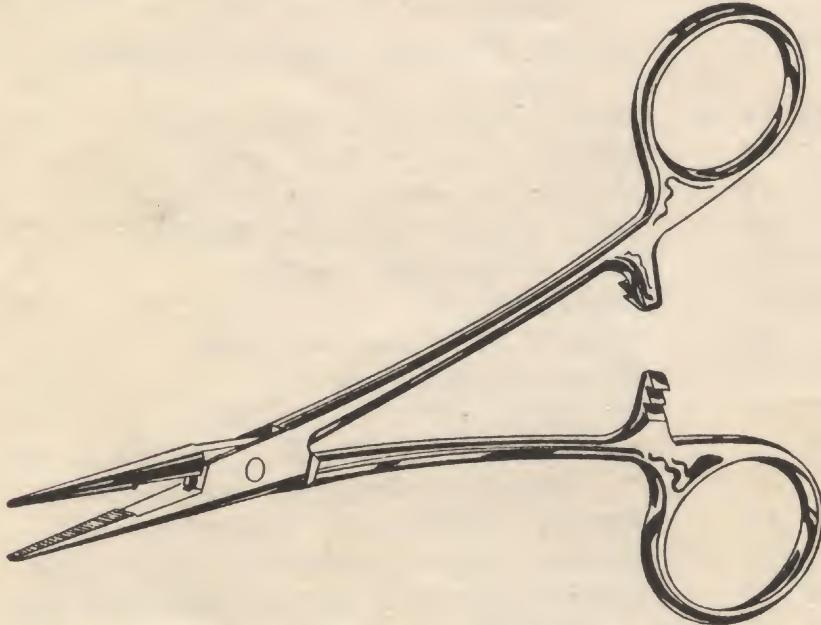


KT 181-A      Wrench, Open End, 1/4" x 3/16"  
                    15 Degrees  
KT 182      Wrench, Open End, 5/16" x 3/8"  
                    65 Degrees  
KT 182-A      Wrench, Open End, 5/16" x 3/8"  
                    15 Degrees  
KT 190      Spring Hook  
KT 191      Spring Hook

Monroe Servicemen carry a "KIT" or Tool Bag known as service accessory "R" and also use a Tool Roll known as accessory "Q".

In servicing our machines, only factory recommended oils, greases, and cleaners are used. These, as with other accessories, tools, machine parts, etc., are obtained from the General Service Department at Orange. A catalog, G.S.B. #G-508, illustrating and describing these service tools and accessories is in the files of each Branch and Dealer.

These tools should be kept in good condition at all times and used only for the purpose intended.



## ADVANCING

FROM THIS POINT YOU PROGRESS TO AUTOMATIC MODELS

After you have mastered the L-160-X (or LN-160) model to the satisfaction of your Service Manager, you will be furnished instruction matter on the next model in order of manufacture -- the LA-160. This model is similar to the L-160 with which you are now familiar, but the LA-160 is motor-driven. The letter "A" which follows the "L" indicates "automatic", (motor-driven) or (electric machine). You will find it very interesting inasmuch as it contains additional mechanism for starting, reversing, and stopping the revolutions, or cycles, of the mechanism which you have just mastered.

We would mention here that as you sit with the keyboard of the machine facing you, the part closest to you is identified as the front of the machine. The side to your right will be the right-hand side of the machine. This will hold true regardless of which position a machine may be found in, i.e., the front will always be the part that brings the zero keytops nearest to you.

Attached hereto is an envelope containing a set of photos with descriptions of automatic models LA-160, LA-5, LA-6, MA-3, MA-7, CS, CST, CSA, and CAA. We suggest you study them and acquaint yourself with their features.

